An Integrated Quality Assurance Program for a Nationwide Precipitation Chemistry Network
National Atmospheric Deposition Program/National Trends Network (NADP/NTN)

Karen S. Harlin & Jane E. Rothert
National Atmospheric Deposition Program, Illinois State Water Survey, Champaign, IL, USA
John Gordon
Precipitation Chemistry Quality Assurance, U.S. Geological Survey, Denver, CO, USA

National Atmospheric Deposition Program (NADP)

- how human activities and the forces of nature affect air and
n chemistry quality
- information to enable more responsible decisions on how to
nd improve air quality, and how to manage agricultural, forest,
ltural, and energy resources

nd decade of recording high-quality precipitation
ata from three networks
rends Network began in 1978
ic Integrated Research Monitoring Network began in 1992
eposition Network began in 1996

e effort of support
tate, and local governments
cultural Experiment Stations
s
ganizations
able @ http://nadp.sws.uiuc.edu

National Trends Network

- To provide data on the amounts, temporal trends, and geographic distributions of **acids, nutrients, and base cations** in precipitation
- Weekly precipitation collection
- **231 collection sites**

Analytes Measured

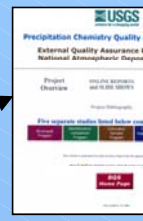
- Acid rain species
  - pH (H^+)
  - SO_4^{2-} (reporting limit = 0.010 mg/L)
  - NO_3^- (reporting limit = 0.010 mg/L)
- Nutrients
  - NO_3^- (reporting limit = 0.010 mg/L)
  - NH_4^+ (reporting limit = 0.02 mg/L)
  - ortho-PO_4^{3-} (reporting limit = 0.009 mg/L)
- Base cations
  - Ca^{2+} (reporting limit = 0.009 mg/L)
  - Mg^{2+} (reporting limit = 0.003 mg/L)
  - K^+ (reporting limit = 0.003 mg/L)
- Other
  - Na^+ (reporting limit = 0.003 mg/L)
  - Cl^- (reporting limit = 0.005 mg/L)

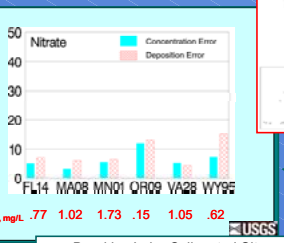
The Quality Assurance Program

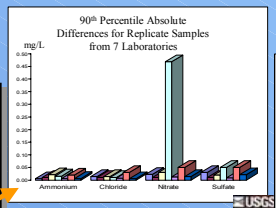
- **Objective**
  - Ensure high quality results for samples of low concentration and low ionic strength
  - Monitor sample collection, transport, and handling procedures
  - Monitor field and laboratory chemistry results
- **Cooperative effort**
  - U.S. Geological Survey
  - U.S. Environmental Protection Agency
  - NADP Central Analytical Laboratory (CAL)
  - NADP Program Office

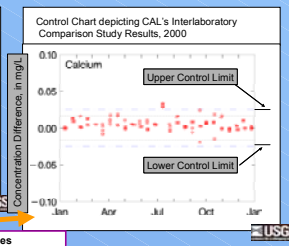
Where to find results ?

- **NADP**
  - http://nadp.sws.uiuc.edu
- **USGS**
  - http://bqs.usgs.gov/precip/project_overview/index.htm
- **Central Analytical Laboratory**
  - http://nadp.sws.uiuc.edu/cal/
- **U.S. EPA**
  - http://www.epa.gov/airmarkets/acidrain/index.html



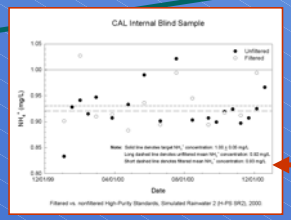


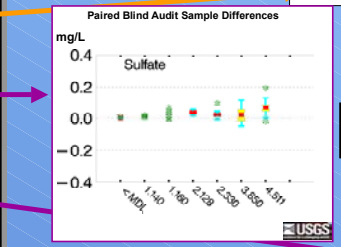


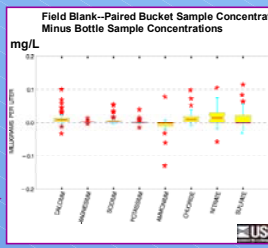


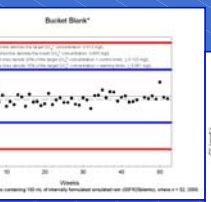
Quality Assurance Parameters

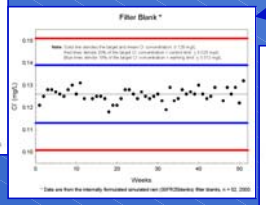
- **Inter-network comparability**
  - Multiple stations where NADP samplers are collocated with other precipitation networks
    - Canadian Air and Precipitation Monitoring Network (CAPMoN)
      - CAN4 & PA15
    - Atmospheric Integrated Research Monitoring Network (NADP daily event research network)
      - IL11, TN00, PA15, and VT99
- **Inter-laboratory comparability**
  - Proficiency tests to assess biases & variability
  - Compare performance of the CAL with other laboratories routinely analyzing low ionic strength samples
- **Network precision**
  - Collocated precipitation collectors & raingages at two sites per year
- **Network bias**
  - **Blind Audit samples** (double and single blind samples):
    - Samples of known composition are sent to station operators who disguise them as precipitation samples and send them to the laboratory
    - Quantifies the contribution of shipping, handling, & processing to results
  - **Field Blank samples** (single blind samples):
    - Samples of known composition are sent to station operators who expose them to collector surfaces and handle them as a regular sample
    - Quantifies the contribution of container surfaces and handling to results
- **Laboratory precision**
  - Samples are split, re-identified, and sent to the laboratory for analysis (double blind)
- **Laboratory bias**
  - Samples of known composition are sent to the laboratory for analysis (double blind)
- **Laboratory quality control**
  - Reagent blanks
  - Procedural blanks
  - Instrument calibration check standards
  - Control charts
  - Random sample reanalysis
  - Targeted reanalysis based on ion balance calculations
  - Internal blind sample analysis
- **Laboratory performance reviews**
  - Detailed review of laboratory operations by an external review team of peer scientists every three years
  - Reviewers report and laboratory response is presented to governing committees
- **Field chemistry evaluation**
  - Samples of known composition are sent to site operators for analysis (single blind)
- **Field site performance reviews**
  - Site visits to test equipment and operator performance, and adherence to installation/siting protocols are conducted every two years
- **Data verification**
  - Rigorous data review, verification, and sample validation coding of field and laboratory data

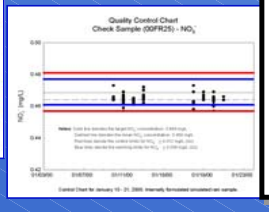


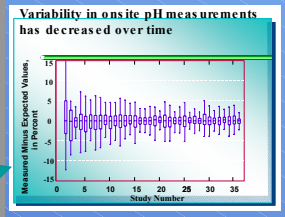












ATS conducts operations f
instrument repair and QA/Q
evaluations in all 50 states
including Puerto Rico and
the US Virgin Islands

ATS